

ABSTRACT

A method and apparatus for determining and displaying polarization profiles of points in a scene from a single imaging detector array, which utilizes a filter system comprised of a retarder, four linear polarizers, four lenses, a color filter, camera lens and CCD video camera. Light from points in a scene are transmitted through the system and exits with attenuated intensities unique for each wavelength of the light. A narrowband color filter selects the wavelength of interest. The four lenses in the system produce four images of the scene, which are recorded as a single CCD-image. The attenuated intensities in each of the four scene-images are used to calculate the Stokes parameters for selected points in the scene for the selected wavelength. The inherent problem of the retarder introducing a different phase differential for each individual wavelength transmitted through the optical element is solved by expressing the Stokes parameters explicitly as a function of wavelength. A computer program separates the four scene-images in the CCD-image, crops, registers them and calculates the Stokes parameters for each point in the cropped scene. A unique pseudo-color scheme that utilizes the Poincaré sphere is used for encoding and displaying polarization parameters. This scheme associates the RGB values of an image with the normalized values of the Stokes parameters. The primary purpose of the method, apparatus and pseudo-color scheme is to obtain the four Stokes parameters simultaneously for each point in a scene and to be able to create video images of changing polarization parameters in real time.